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Martel

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(54) **SYSTEMS AND METHODS FOR SHARING ENCODER OUTPUT**

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(22) Filed: **Apr. 4, 2012**

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(51) **Int. Cl.**

H04N 7/12	(2006.01)
H04N 7/52	(2011.01)
H04N 7/24	(2011.01)
H03M 7/30	(2006.01)
H03M 7/40	(2006.01)

(52) **U.S. Cl.**
CPC . ***H04N 7/52*** (2013.01); ***H04N 7/24*** (2013.01); *H03M 7/3006* (2013.01); *H03M 7/4068* (2013.01); *H03M 7/6047* (2013.01)

(58) **Field of Classification Search**
USPC 375/240.01
See application file for complete search history.

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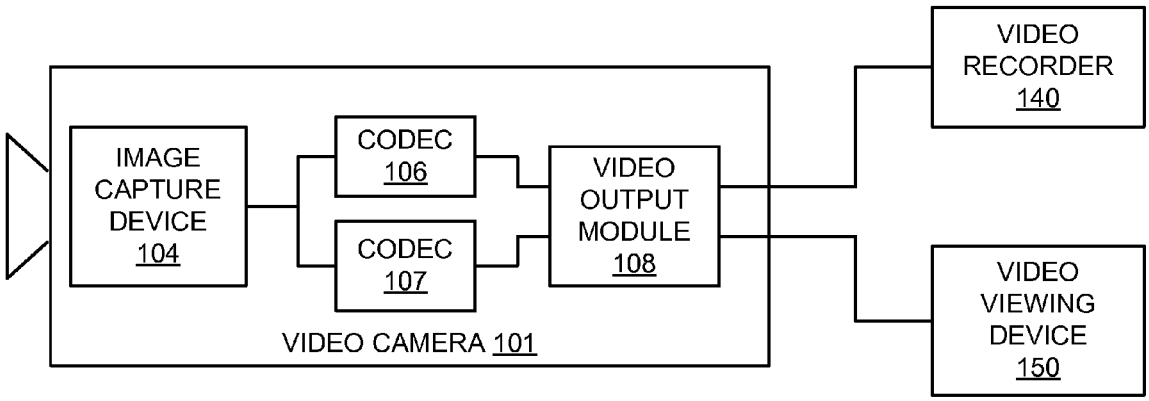
(74) *Attorney, Agent, or Firm* — Meunier Carlin & Curfman

(57) **ABSTRACT**

Embodiments described herein provide systems and methods for sharing encoder output of video streams. In a particular embodiment, a method provides determining video profiles for each of a plurality of devices. The method further provides determining if two or more of the video profiles are similar by determining if parameters associated with each video profile differ by less than a threshold value. The method further provides transmitting a video stream encoded in a single format to the devices if they have similar profiles and transmitting video streams encoded in different formats to the devices if they do not have similar profiles.

3 Claims, 10 Drawing Sheets



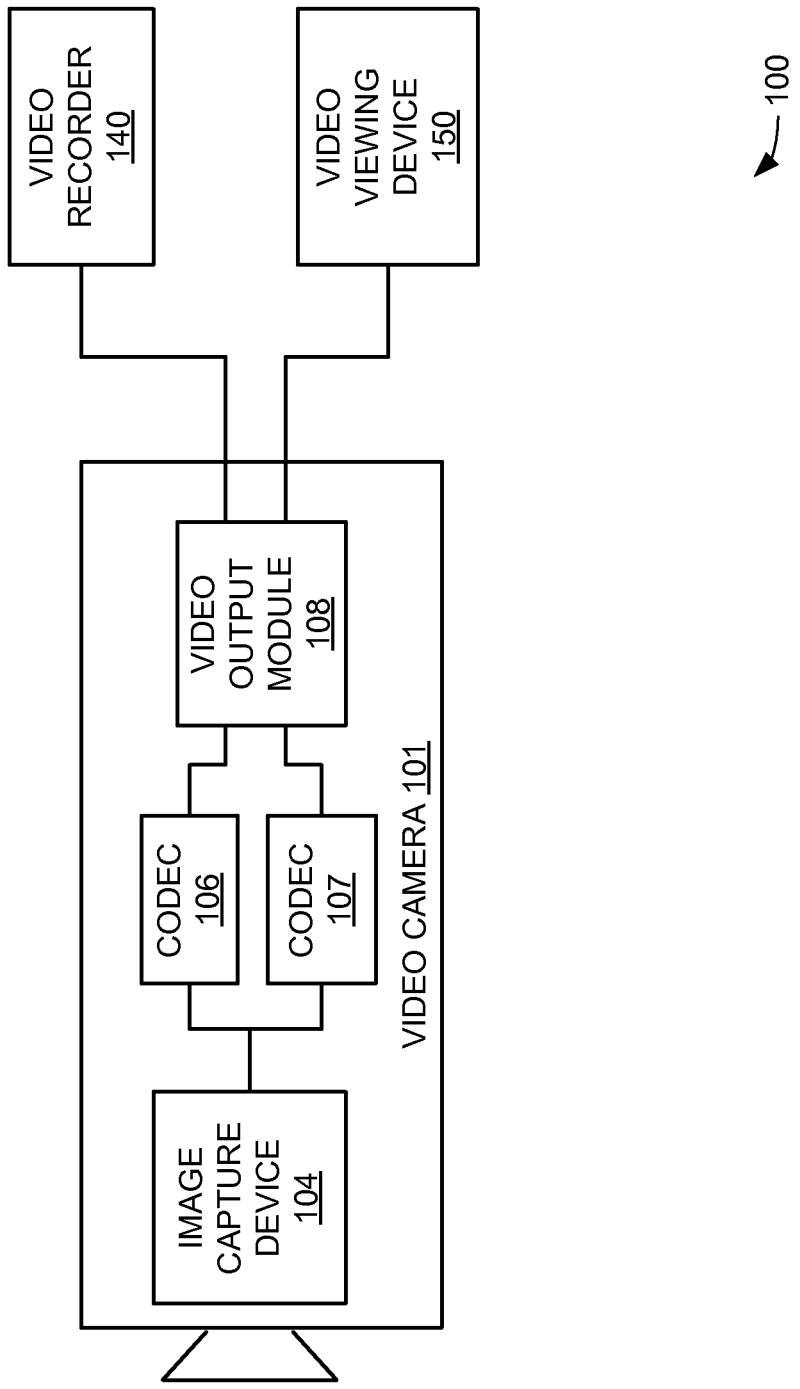

VIDEO RECORDER 140
VIDEO VIEWING DEVICE 150
100
VIDEO OUTPUT MODULE 108
CODEC 106
CODEC 107
IMAGE CAPTURE DEVICE 104
VIDEO CAMERA 101

FIGURE 1

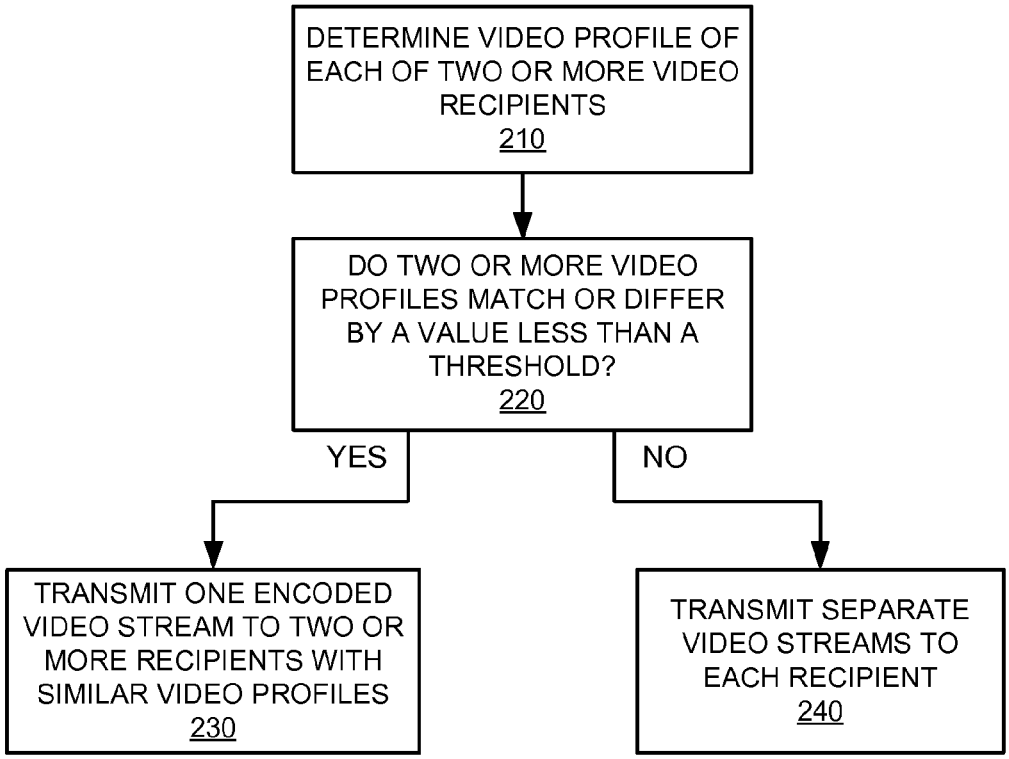

DETERMINE VIDEO PROFILE OF EACH OF TWO OR MORE VIDEO RECIPIENTS
210
DO TWO OR MORE VIDEO PROFILES MATCH OR DIFFER BY A VALUE LESS THAN A THRESHOLD?
220
YES
NO
TRANSMIT ONE ENCODED VIDEO STREAM TO TWO OR MORE RECIPIENTS WITH SIMILAR VIDEO PROFILES
230
TRANSMIT SEPARATE VIDEO STREAMS TO EACH RECIPIENT
240

FIGURE 2

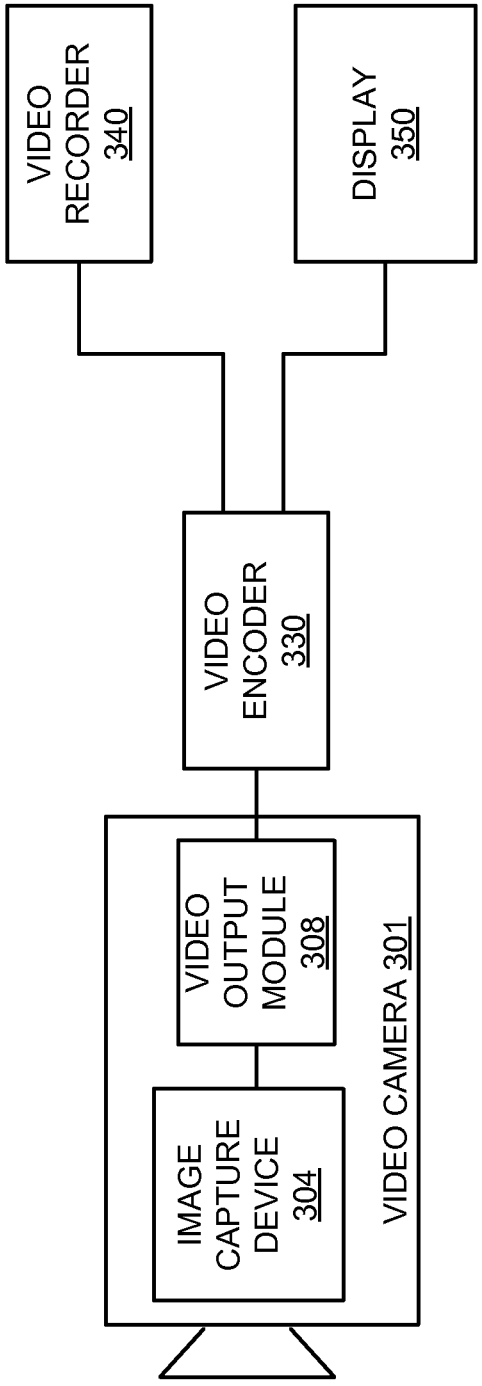

VIDEO RECORDER 340
DISPLAY 350
300
VIDEO ENCODER 330
VIDEO OUTPUT MODULE 308
IMAGE CAPTURE DEVICE 304
VIDEO CAMERA 301

FIGURE 3

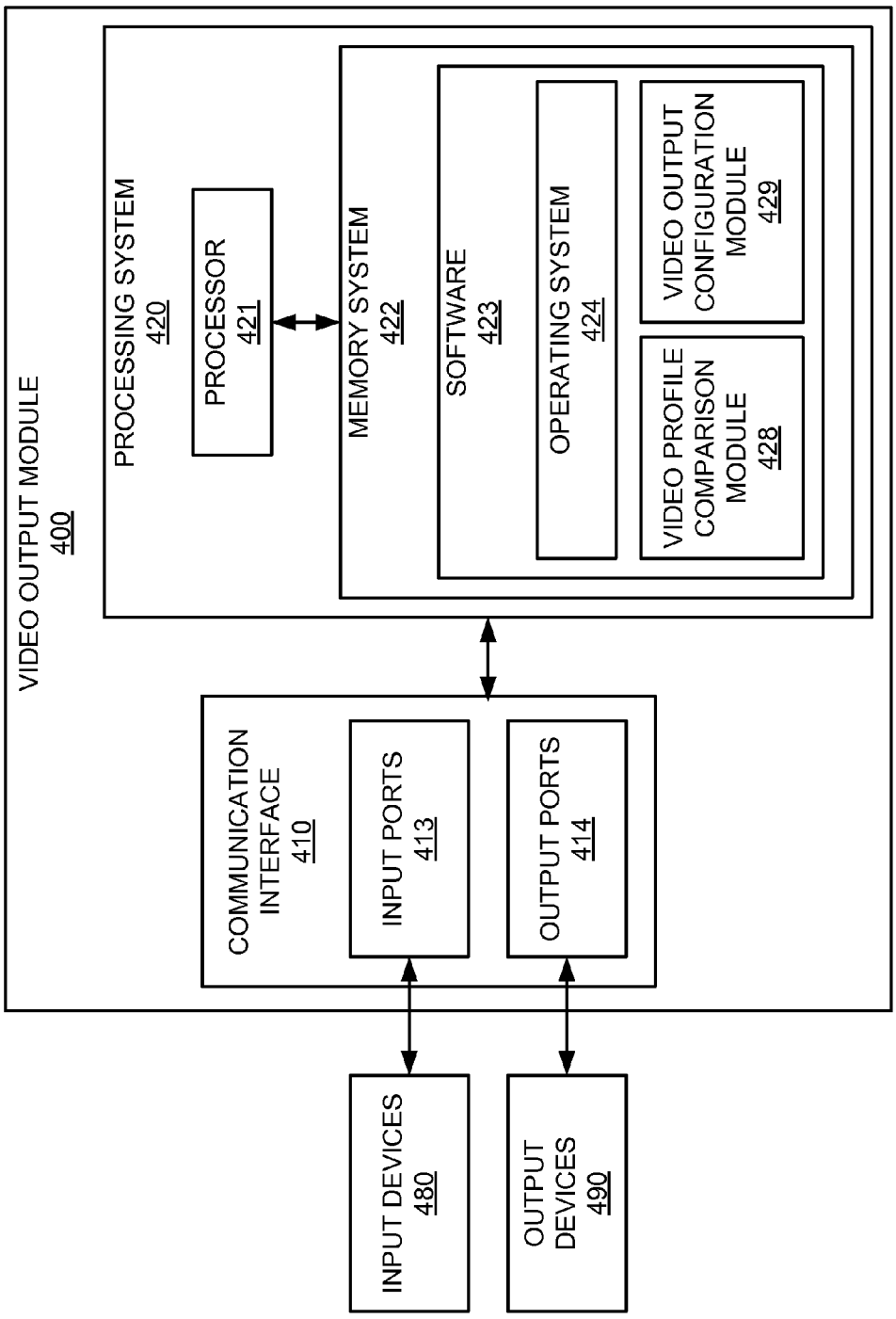

VIDEO OUTPUT MODULE
400
PROCESSING SYSTEM
420
PROCESSOR
421
MEMORY SYSTEM
422
SOFTWARE
423
OPERATING SYSTEM
424
VIDEO PROFILE COMPARISON MODULE
428
VIDEO OUTPUT CONFIGURATION MODULE
429
COMMUNICATION INTERFACE
410
INPUT PORTS
413
OUTPUT PORTS
414
INPUT DEVICES
480
OUTPUT DEVICES
490

FIGURE 4

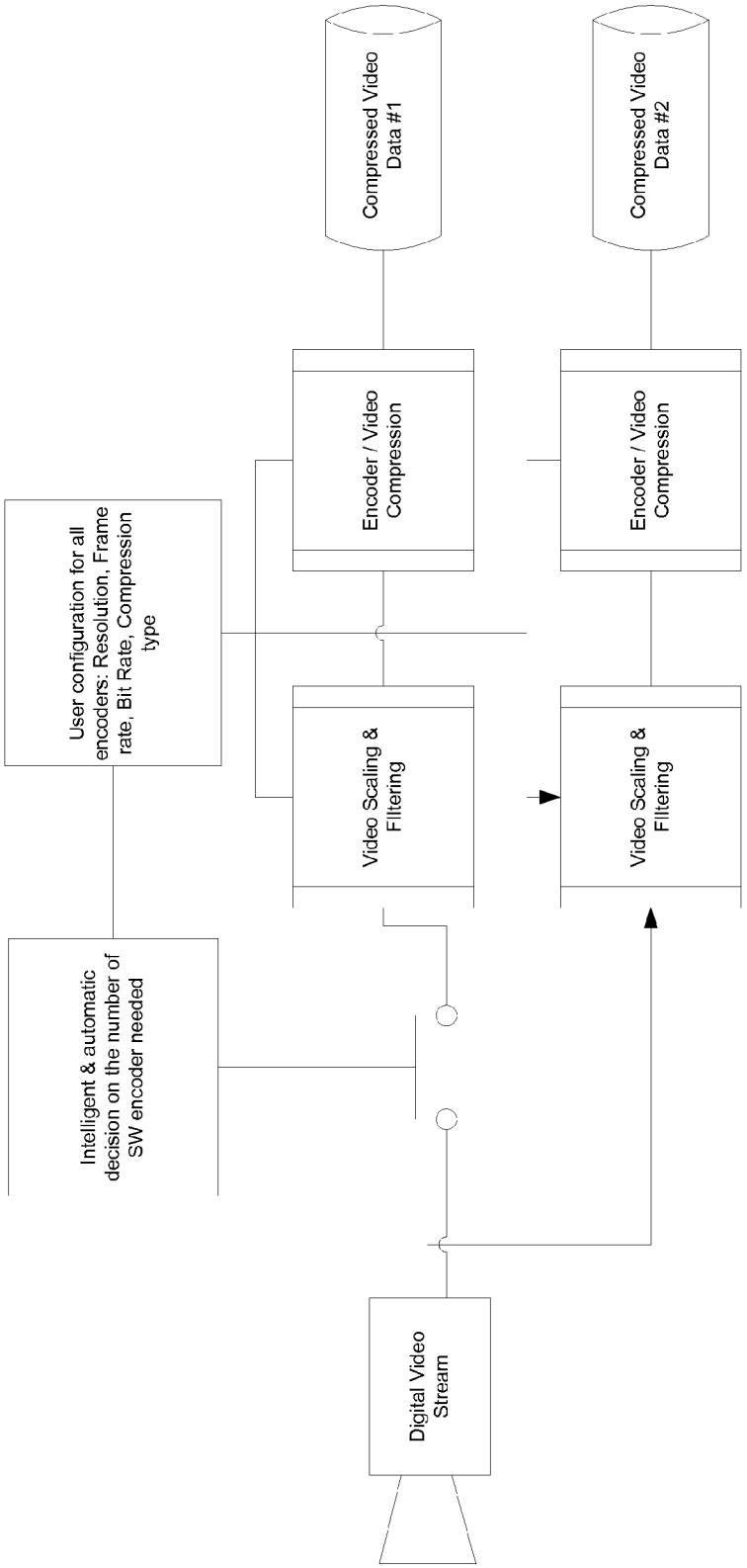

Compressed Video Data #1
Compressed Video Data #2
Encoder / Video Compression
Encoder / Video Compression
User configuration for all encoders: Resolution, Frame rate, Bit Rate, Compression type
Video Scaling & Filtering
Video Scaling & Filtering
Intelligent & automatic decision on the number of SW encoder needed
Digital Video Stream

FIGURE 5

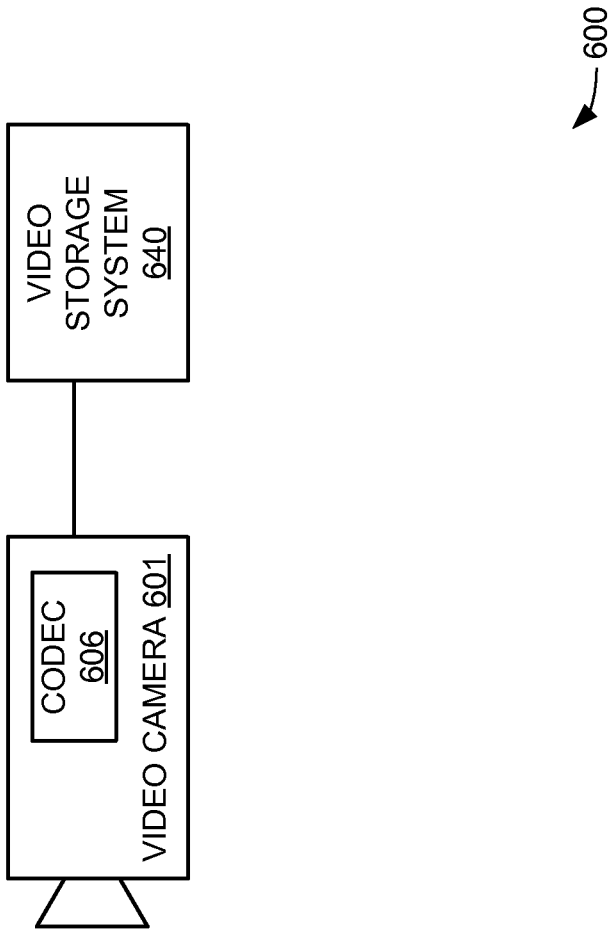


FIGURE 6

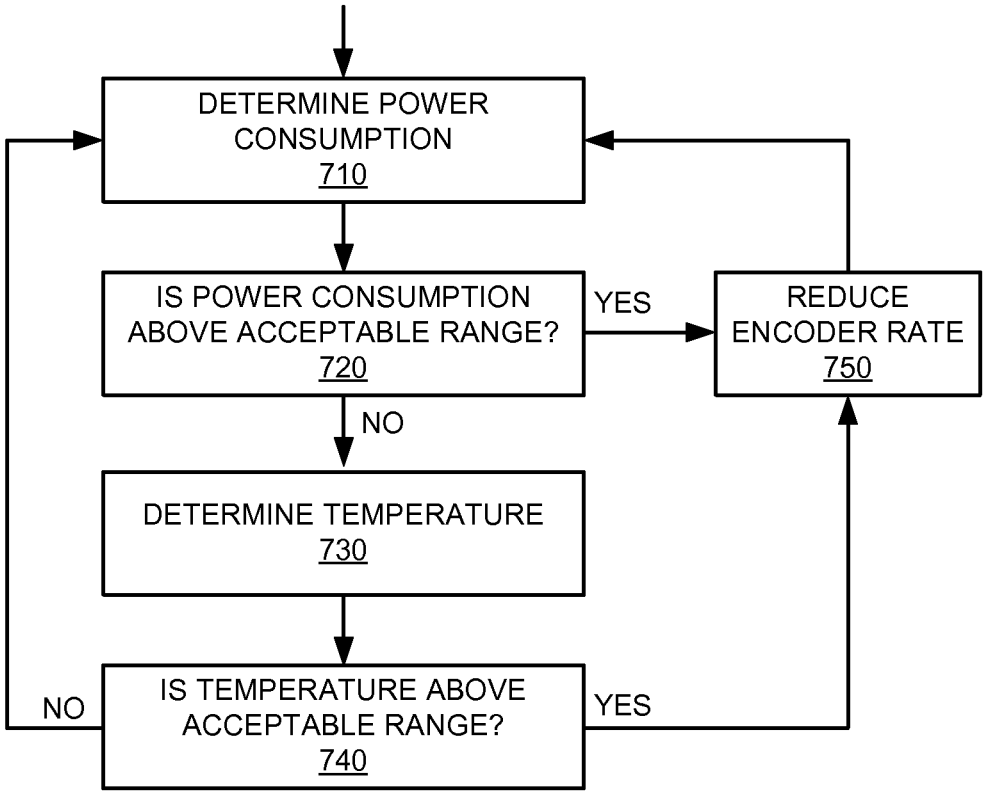

DETERMINE POWER CONSUMPTION
710
IS POWER CONSUMPTION ABOVE ACCEPTABLE RANGE?
720
YES
REDUCE ENCODER RATE
750
NO
DETERMINE TEMPERATURE
730
IS TEMPERATURE ABOVE ACCEPTABLE RANGE?
740
NO
YES

FIGURE 7

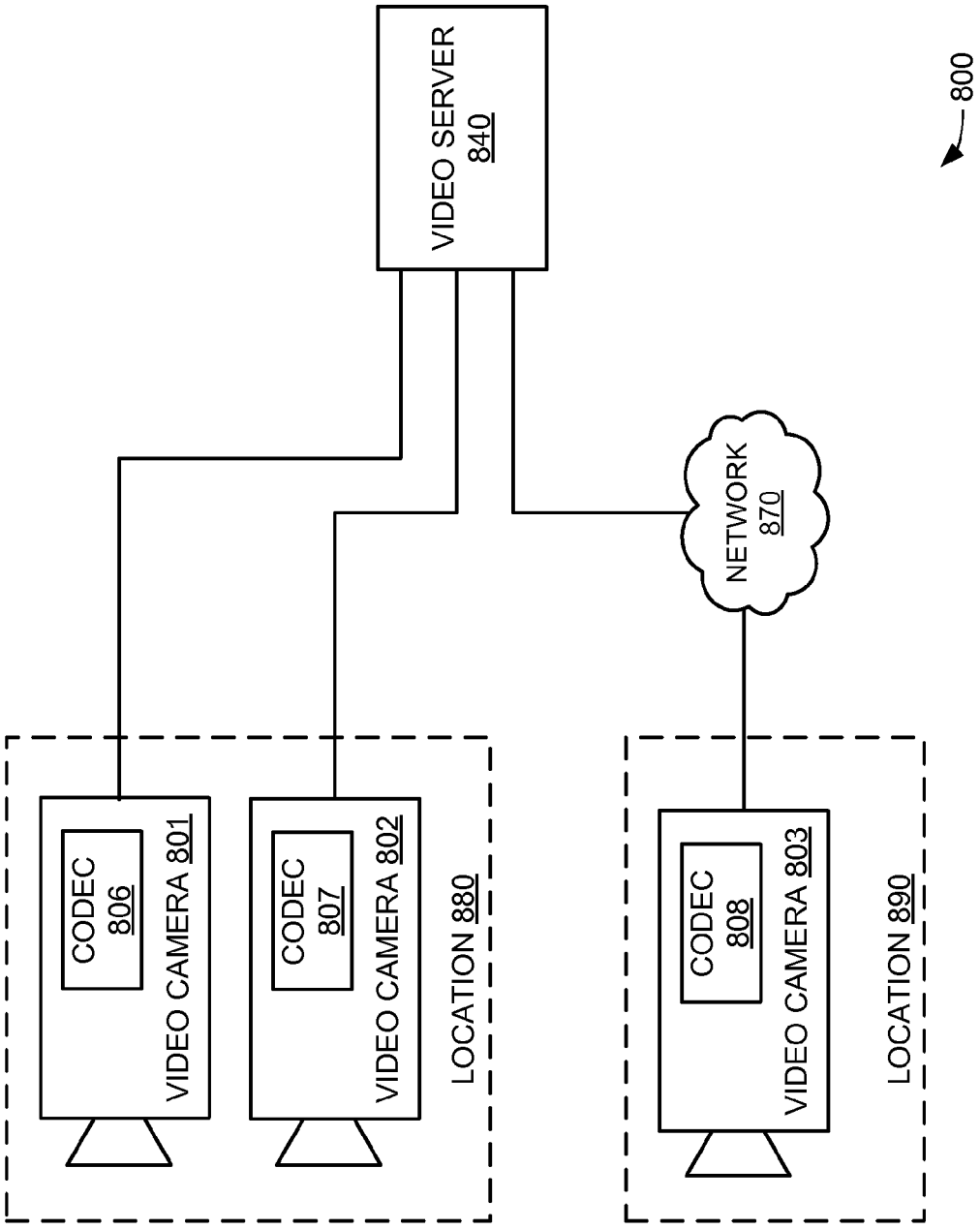

800
VIDEO SERVER 840
NETWORK 870
LOCATION 880
CODEC 806
VIDEO CAMERA 801
CODEC 807
VIDEO CAMERA 802
LOCATION 890
CODEC 808
VIDEO CAMERA 803

FIGURE 8

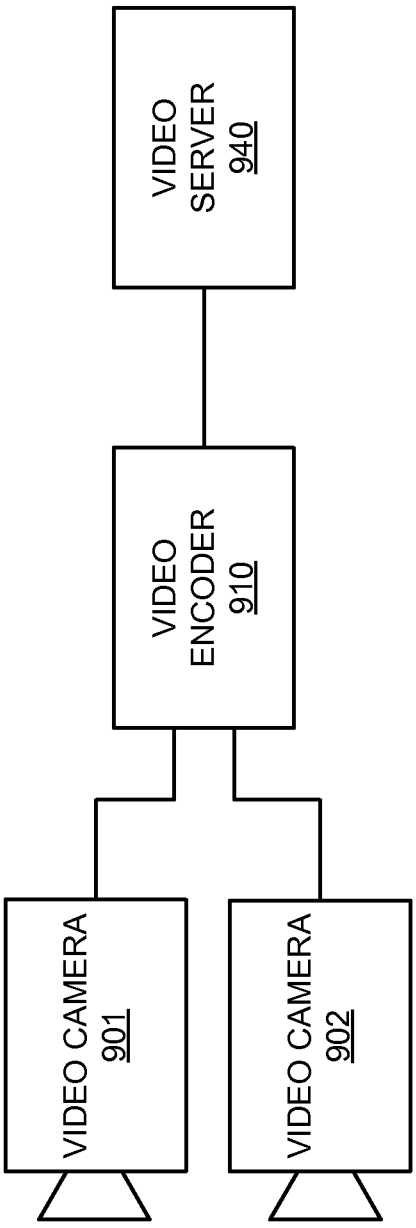

VIDEO SERVER 940
VIDEO ENCODER 910
VIDEO CAMERA 901
VIDEO CAMERA 902
900

FIGURE 9

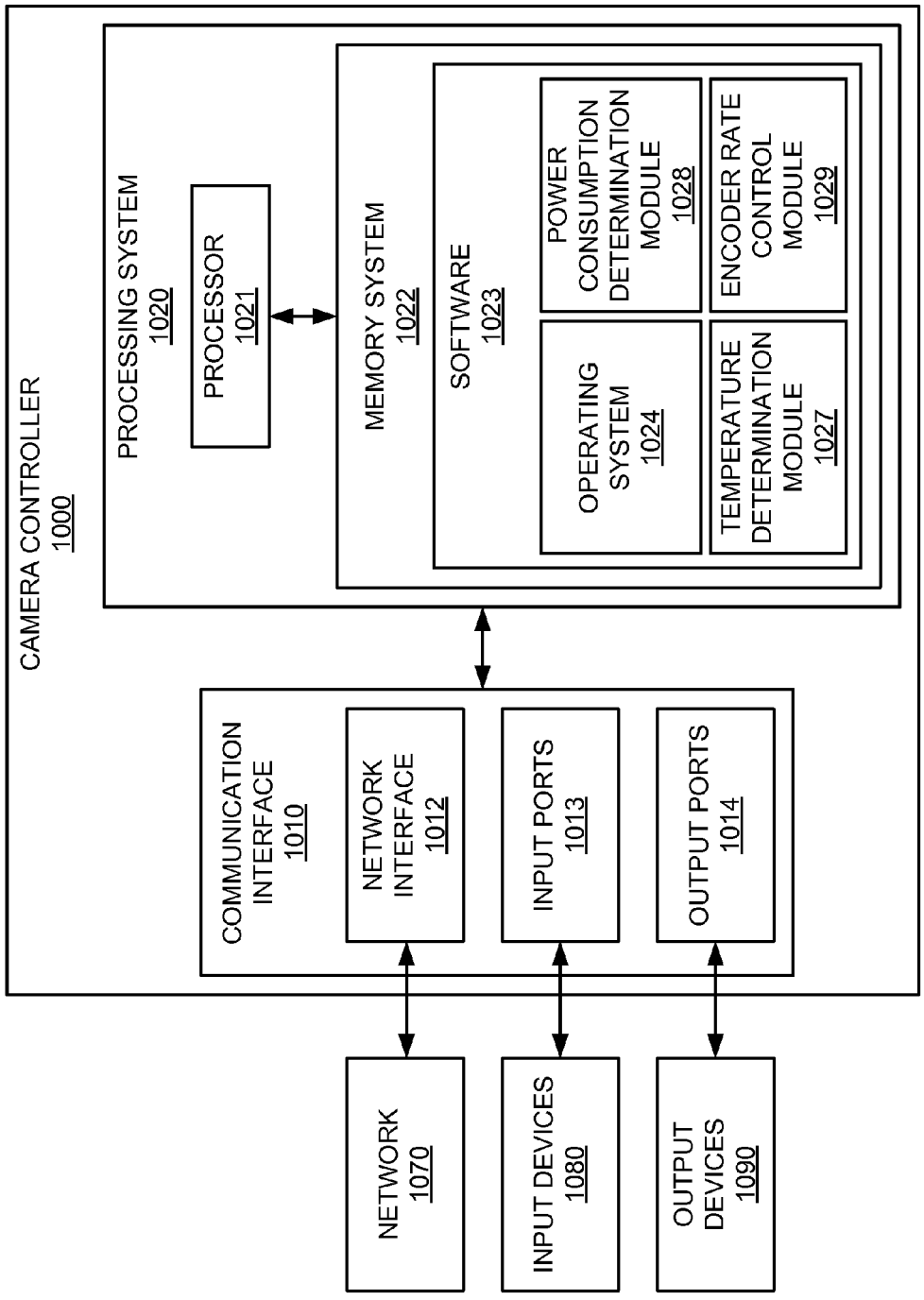

CAMERA CONTROLLER
1000
PROCESSING SYSTEM
1020
PROCESSOR
1021
MEMORY SYSTEM
1022
SOFTWARE
1023
OPERATING SYSTEM
1024
POWER CONSUMPTION DETERMINATION MODULE
1028
TEMPERATURE DETERMINATION MODULE
1027
ENCODER RATE CONTROL MODULE
1029
COMMUNICATION INTERFACE
1010
NETWORK INTERFACE
1012
INPUT PORTS
1013
OUTPUT PORTS
1014
NETWORK
1070
INPUT DEVICES
1080
OUTPUT DEVICES
1090

FIGURE 10

SYSTEMS AND METHODS FOR SHARING ENCODER OUTPUT

RELATED APPLICATIONS

This application claims the benefit of U.S. Provisional Application No. 61/472,068, filed Apr. 5, 2011, and U.S. Provisional Application No. 61/471,312, filed Apr. 4, 2011, which are hereby incorporated by reference in their entirety.

TECHNICAL BACKGROUND

Video systems contain many different types of devices which may receive, process, store, or transmit video in different formats. These devices may be cameras, recorders, viewing devices, storage devices, transmission devices, coder-decoders (codecs), encoders, or other devices. These different devices may use different video formats due to hardware limitations, software limitations, bandwidth requirements, storage limitations, interface requirements, or for other reasons. Many different video formats are possible. As a result, video may be transmitted or stored in multiple different formats within a single video system. Each video format that is generated requires the resources of a codec or encoder to generate an instance of the video in each format.

OVERVIEW

Embodiments described herein provide systems and methods for sharing encoder output of video streams. In a particular embodiment, a method provides determining video profiles for each of a plurality of devices. The method further provides determining if two or more of the video profiles are similar by determining if parameters associated with each video profile differ by less than a threshold value. The method further provides transmitting a video stream encoded in a single format to the devices if they have similar profiles and transmitting video streams encoded in different formats to the devices if they do not have similar profiles.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** illustrates a video system.

FIG. **2** illustrates an operation of a video system.

FIG. **3** illustrates a video system which uses a video encoder.

FIG. **4** illustrates a video output module.

FIG. **5** illustrates as video system with two video encoders.

FIG. **6** illustrates a video system.

FIG. **7** illustrates an operation of a video system.

FIG. **8** illustrates a video system with cameras in two locations.

FIG. **9** illustrates a video system with a shared video encoder.

FIG. **10** illustrates a camera controller.

DETAILED DESCRIPTION

FIGS. **1-10** and the following description depict specific embodiments of the invention to teach those skilled in the art how to make and use the best mode of the invention. For the purpose of teaching inventive principles, some conventional aspects have been simplified or omitted. Those skilled in the art will appreciate variations from these embodiments that fall within the scope of the invention. Those skilled in the art will appreciate that the features described below can be combined in various ways to form multiple embodiments and variations of the invention. As a result, the invention is not limited to the specific embodiments described below, but only by the claims and their equivalents.

Video systems are often configured to generate video streams in multiple different formats. Different video formats may be needed by or desired for various devices or users in the system. Different formats may be used due to hardware limitations, software limitations, bandwidth constraints, storage limitations, interface requirements, or for other reasons. For example, it may be desirable for users of a system to view live video streams in the highest possible available resolution and frame rate while the video stream provided to a video recorder for archiving purposes may have to be at a lower resolution or frame rate due to storage space limitations.

In another example, one video receiving device may be within the same network as the video source or connected by a high speed connection, while a second video receiving device has a more limited connection to the video system. The connection limitations may require that video be sent to the second receiving device at a lower resolution or frame rate. This means the video has to be encoded in a separate format for this second device. Using a second encoder may place additional software, hardware, power, or processing requirements on the system.

The following is a non-exhaustive list of video formats which may be used in the video systems described herein: MPEG-1, MPEG-2, MPEG-4, MPEG-7, MPEG-21, H.264, DV, MiniDV, DVCAM, DVCPRO, DVCPRO50, DVCPRO HD, HDV, DVD, Blu-Ray, HD-DVD, HD-VMD, CH-DVD, HDTV, 1080i, 1080p, Flash, Quicktime, RealMedia, VHS, VHS-C, S-VHS, S-VHS-C, D-VHS, Windows Media, 8 mm, Video8, Hi8, Digital8, Beta, Betamax, Betacam, Betacam SP, Betacam SX, Digital Betacam, 3GP, and 3G2.

A video profile of a device indicates which video format or formats a device is capable of receiving and processing. The video profile also may specify further video parameters within each video format. These further parameters may include bit rate, frame rate, image resolution, or other parameters. These parameters vary between different video formats and may even vary within a single video format. In other words, two video streams may both be transmitting the same video in MPEG-4 format but may each have a different bit rate, frame rate, or resolution. A video profile specifies the formats of video which are acceptable to a device as well as these other parameters for each of the formats, including ranges of parameters if applicable.

FIG. **1** illustrates video system **100**. Video system **100** comprises video camera **101**, video recorder **140**, and video viewing device **150**. Video camera **101** comprises image capture device **104**, codecs **106-107**, and video output module **108**. Each of video recorder **140** and video viewing device **150** have a video profile specifying acceptable formats and parameters for that device. Codecs **106-107** generate video in different formats and provide the formatted video to video output module **108**. It should be understood that video recorder **140** and video viewing device **150** may be replaced or supplemented by many other types of devices which receive, process, relay, display, or store video.

FIG. **2** illustrates an operation of video system **100**. The steps of operation are indicated below parenthetically. Video output module **108** determines the video profiles associated with video recorder **140** and video viewing device **150** (**210**). Video output module **108** may make this determination based on information received from video recorder **140** and video viewing device **150**, based on information already contained within video output module **108**, or based on information obtained from other sources.

Video output module **108** then determines if the video profile of video recorder **140** and video viewing device **150** match or differ by a value less than a threshold (**220**). For example, the profiles of both video recorder **140** and video viewing device **150** may indicate they are configured to receive MPEG-4 video and do so at the same frame rates, bit rates, and resolution. These would be matching video profiles.

In another example, both video recorder **140** and video viewing device **150** may be configured to receive MPEG-4 video but may have different specified frame rates, bit rates, resolutions, or other parameters. For example, the profile of video viewing device **150** may indicate a frame rate which is higher than that of video recorder **140**. If one or more parameters differ by a value less than a specified threshold amount, the two profiles may be treated as similar. For example, if a threshold value is set at 20% and the differences in the frame rates in the profiles of video recorder **140** and video viewing device **150** differ by less than 20%, they may be treated as being similar enough to receive the same video stream. Many other types of threshold comparisons are possible including combinations of multiple thresholds for multiple parameters.

Continuing with FIG. **2**, if the profiles match or are similar, as determined by the threshold method described above, video output module **108** transmits the same encoded video stream to both video recorder **140** and video viewing device **150** (**230**). This may be true even though the parameters of the video stream do not necessarily identically match all of the parameters of one or more of the receiving device. In this case, only one of codecs **106-107** may need to be operated because the output of one of them will be sufficient to supply video streams to both receiving devices. In this way power, processing resources, or other resources can be saved by using only one of codecs **106-107** to meet the needs of both devices.

If the video profiles do not match or are not sufficiently similar, separately encoded video streams will be transmitted to each of video recorder **140** and video viewing device **150** by video output module **108** (**240**). Codec **106** and codec **107** will be simultaneously operated to produce the two differing video streams.

Referring back to FIG. **1**, video camera **101** comprises image capture device **104**, codecs **106-107**, and video output module **108**. Video camera **101** may also comprise other components or circuitry for capturing and transmitting images. For example, video camera **101** may be an analog camera, digital camera, internet protocol (IP) camera, or other type of camera. Image capture device **104** performs the initial optical capture of images and translates them into electronic signals, digital values, or some combination thereof. Image capture device **104** may be a sensor, charge-coupled device (CCD) or other similar device.

It should be understood that the remainder of the functions described herein with respect to video camera **101** may be performed by other devices which transmit video even though they do not perform the initial optical capture of the video. For example, video camera **101** could also be replaced in FIG. **1** by a video switch, video buffer, video server, or other video transmission device, including combinations thereof.

Codecs **106-107** comprise software or circuitry for coding or decoding video signals. Codecs **106-107** may be implemented entirely in software and executed on a processor of video camera **101**, may be implemented in hardware, or may be implemented using some combination of hardware and software. Codecs **106-107** may not actually be two separate devices but may be one set of software or hardware which is capable of simultaneously encoding or decoding video streams in two or more different formats. Each codec may be configured to produce video in only one format or may be capable of producing video in many different formats. Codecs **106-107** may also perform analog-to-digital conversion, transformations, mathematical computations, modifications, formatting, conditioning, other processes, or combinations thereof.

Video output module **108** comprises an interface for transmitting video. Video output module **108** module may also comprise additional interfaces for receiving and transmitting video in various formats. Video output module **108** also contains circuitry or software for determining similarities in video profiles and transmitting video to video recorder **140**, video viewing device **150**, or other recipient devices based of their video profiles. Video output may also contain circuitry or software for switching, multiplexing, buffering, conditioning, or otherwise modifying video signals or packets of video data. Video output module **108** is illustrated in FIG. **1** as being part of video camera **101** but could be implemented outside of video camera **101**.

Video recorder **140** receives video from video output module **108** and records the video. Video recorder **140** comprises an interface for receiving video and components for storing the video. The storage components of video recorder **140** may comprise a disk drive, optical disk, flash memory, solid state memory, tape drive, or other device for storage of digital data, including combinations thereof. Video recorder **140** may also comprise additional interfaces for transmitting or receiving video or images, a user interface, software, a power supply, or structural support. Video recorder **140** may be a computer, server, disk array, or other device which stores video, including combinations thereof. Video recorder **140** may also perform other processing, conditioning, formatting, or analysis on the recorded video.

Video viewing device **150** comprises any device for displaying video to a user. Video viewing device **150** displays video received from video output module **108**. Video viewing device **150** may comprise a liquid crystal display (LCD), cathode ray tube (CRT), or other type of display device. Video viewing device **150** may be a component of a computer system, communication device, or other type of system.

FIG. **3** illustrates video system **300** which uses a video encoder. Video system **300** comprises video camera **301**, video encoder **330**, video recorder **340**, and display **350**.

Video camera **301** comprises image capture device **304** and video output module **308**. Video camera **301** is an example of video camera **101** although video camera **301** may have an alternate configuration or operate in an alternate manner. Codecs **106-107** of video camera **101** are not illustrated as components of video camera **301** but video camera **301** may contain similar functions.

Video recorder **340** is an example of video recorder **140** although video recorder **340** may have an alternate configuration or operate in an alternate manner. Display **350** is an example of video viewing device **150** although display **350** may have an alternate configuration or operate in an alternate manner.

Video encoder **330** processes, converts, or formats video, video streams, or images. Video encoder **330** comprises processing circuitry and an interface for receiving and transmitting video. Video encoder **330** is capable of performing one or more processes on video received from one or more video sources including video camera **301**. The processes performed on the video may include analog-to-digital conversion, transformations, mathematical computations, modifications, formatting, conditioning, other processes, or combinations thereof. Video encoder **330** performs processes

similar to those described with respect to codecs **106-107**. Video encoder **330** contains software or hardware modules which encode video signals. Video encoder **330** may use separate interfaces for receiving and transmitting video. Video encoder **330** may also comprise a user interface, memory, software, communication components, a power supply, or structural support.

Video system **300** performs functions similar to those described with respect to video system **100** although the operation of video system **300** may vary. In one example of operation, video encoder determines the video profiles associated with video recorder **340** and display **350**. Video encoder **330** may make this determination based on information received from video recorder **340** and display **350**, based on information already available to video encoder **330**, or based on information obtained from other sources.

Video encoder **330** determines if the video profile of video recorder **340** and display **350** match or differ by a value less than a threshold. For example, the profiles of both video recorder **340** and display **350** may indicate they are configured to receive H.264 video and do so at the same frame rates, bit rates, and resolution. These would be matching video profiles.

In another example, both video recorder **340** and display **350** may be configured to receive H.264 video but may have other profile parameters which differ. For example the video profile of display **350** may indicate a resolution which is higher than that of video recorder **340**. Even though the resolution parameters are different, if they differ by less than a threshold value they may still be treated as matching. For example, if a threshold value is set at 10% and the differences in the resolutions specified in the profiles of video recorder **340** and display **350** differ by less than 10%, they may be treated as being similar enough to receive the same video stream. The threshold may also be specified in terms of an absolute difference rather than a percentage difference. Many other types of threshold comparisons are possible including combinations of multiple thresholds for multiple parameters.

If the video profiles match or are similar, as determined by the threshold method described above, video encoder **330** transmits the same encoded video stream to both video recorder **340** and display **350**. This may be true even though the parameters of the video stream do not identically match all of the parameters of one or more of the receiving devices. In this way, video encoder **330** is able to execute a single video encoding process to meet the needs of both devices. If this is not the case, video encoder would need to operate two or more video encoding processes to produce video streams which match the video profiles. This may require additional power, processing resources, configuration, software, or even an additional video encoder.

If the video profiles do not match or are not sufficiently similar based on the comparison processes described above, separately encoded video streams will be transmitted to each of video recorder **340** and display **350**.

Video encoder **300** may operate in a manner similar to that described above and provide the same video stream to video recorder **340** and display **350** even though their profiles indicate different video formats if those different video formats have sufficient common characteristics.

FIG. **5** illustrates a video system similar to video system **300** which uses two separate video encoders. The functions performed by video encoder **330** of FIG. **3** are split between the video scaling and filtering devices and encoder/video compression devices of FIG. **5**.

FIG. **4** illustrates video output module **400**. Video output module **400** is an example of video output module **108** although video output module **400** may have an alternate configuration or operate in an alternate manner. Video output module **400** includes communication interface **410** and processing system **420**. Processing system **420** is linked to communication interface **410** through a communication link. Processing system **420** includes processor **421** and memory system **422**.

Communication interface **410** includes input ports **413**, and output ports **414**. Communication interface **410** includes components that communicate over communication links, such as network cards, ports, RF transceivers, processing circuitry and software, or some other communication device. Communication interface **410** may be configured to communicate over metallic, wireless, or optical links. Communication interface **410** may be configured to use TDM, IP, Ethernet, optical networking, wireless protocols, communication signaling, or some other communication format, including combinations thereof. Codecs **106-107** are examples of input devices **480**. Video recorder **140** and video viewing device **150** are examples of output devices **490**.

Processor **421** includes microprocessor and other circuitry that retrieves and executes operating software from memory system **422**. Memory system **422** comprises software **423**. Memory system **422** may be implemented using random access memory, read only memory, a hard drive, a tape drive, flash memory, optical storage, or other memory apparatus.

Software **423** comprises operating system **424**, video profile comparison module **428**, and video output configuration module **429**. Software **423** may also comprise additional computer programs, firmware, or some other form of non-transitory, machine-readable instructions. Video output module **400** is capable of receiving encoded video streams from codecs **106-107** through input ports **413**. When executed by processor **421**, software **423** directs processing system **420** to operate video processing system **400** to determine if two or more video profiles match or differ by a value less than a threshold using video profile comparison module **428**. Software **423** also directs processing system **420** to configure output ports **414** to transmit the same encoded video stream to devices associated with the matching or similar profiles using video output configuration module **429** and output ports **414**.

The systems and methods described above with respect to FIGS. **1-5** may be used in conjunction with, or integrated within, the systems and methods described below with respect to FIGS. **6-10** for varying encoder rate of the video streams based on power or temperature. Alternatively, the systems and methods described below may be used independently.

Video encoders and codecs are used in video systems to convert video from one format to another. The conversion may be from analog to digital, from a raw digital format to MPEG, or between many other possible formats. The encoders or codecs may be located at many different places within the system. The following is a non-exhaustive list of video formats which may be used in the video systems described herein: MPEG-1, MPEG-2, MPEG-4, MPEG-7, MPEG-21, H.264, DV, MiniDV, DVCAM, DVCPRO, DVCPRO50, DVCPRO HD, HDV, DVD, Blu-Ray, HD-DVD, HD-VMD, CH-DVD, HDTV, 1080i, 1080p, Flash, Quicktime, RealMedia, VHS, VHS-C, S-VHS, S-VHS-C, D-VHS, Windows Media, 8 mm, Video8, Hi8, Digital8, Beta, Betamax, Betacam, Betacam SP, Betacam SX, Digital Betacam, 3GP, and 3G2.

In addition, there may be multiple parameters within each format which may be varied including bit rate, frame rate, resolution, or other parameters. Throughout this description, adjustment of any one or more of these parameters is referred

to as adjusting the 'encoder rate.' Adjusting the encoder rate may refer to the operation of a codec, video encoder, or other video formatting device. Since video encoding is a computationally intensive process, varying the encoder rate affects the processing requirements in the system, as well as affecting how much data must be transmitted to other devices in the system. In turn, these factors affect how much power is used by the system and how much heat is generated by the system.

FIG. **6** illustrates video system **600**. Video system **600** comprises video camera **601** and video storage system **640**. Video camera **601** comprises codec **606**. Video camera **601** captures video of a scene and codec **606** performs processing which encodes or formats the video in a format which is compatible with video storage system **640**. In FIG. **6**, it should be understood that video storage system **640** may be replaced or supplemented by many other types of devices which receive, process, relay, display, or store video. It should also be understood that the function performed by codec **606** may also be performed outside of video camera **601**.

FIG. **7** illustrates an operation of video system **600**. The steps of operation are indicated below parenthetically. Video system **600** determines how much power is being consumed (**710**) and then determines if the power consumption is outside of an acceptable range (**720**). The measured power consumption and range may pertain to the whole system, video camera **601**, codec **606**, or some other subset of video system **600**. If the power consumption is above the acceptable range, the encoder rate of codec **606** is reduced (**750**). Reducing the encoder rate may include reducing the frame rate, bit rate, resolution, other video parameter, or combinations thereof.

If the power consumption does not exceed an acceptable range, the temperature is determined (**730**). The temperature may refer to the ambient temperature of the environment in which video camera **601** is operating, the temperature of video camera **601** itself, or the temperature of codec **606**. If the temperature is above an acceptable range, the encoder rate of codec **606** is reduced (**740**). It should be understood that the power consumption and temperature may be determined in a different order, at different times, or at different frequencies.

Referring back to FIG. **6**, video camera **601** comprises codec **606**. Video camera **601** may also comprise other components or circuitry for capturing and transmitting images. For example, video camera **601** may be an analog camera, digital camera, internet protocol (IP) camera, or other type of camera. It should be understood that video camera **601** may have more than one codec. It should also be understood that the remainder of the functions described herein with respect to video camera **601** may be performed by other devices which transmit video even though they do not perform the initial optical capture of the video. For example, video camera **601** could also be replaced in FIG. **6** by a video switch, video buffer, video server, or other video transmission device, including combinations thereof, which perform a video processing function.

Codec **606** comprises software or circuitry for coding or decoding video signals. Codec **606** may be implemented entirely in software and executed on a processor of video camera **601**, may be implemented in hardware, or may be implemented using some combination of hardware and software. Codec **606** may be capable of simultaneously producing video in multiple formats or may be switchable between multiple formats. Codec **606** may also perform analog-to-digital conversion, transformations, mathematical computations, modifications, formatting, conditioning, other processes, or combinations thereof.

FIG. **8** illustrates video system **800** which provides video monitoring capabilities in two locations. Video system **800** comprises video cameras **801-803** at locations **880** and **890**, network **870**, and video server **840**. Locations **880** and **890** may be different physical locations or may be different logical locations within a system which is at a single physical location.

Video server **840** receives video from video cameras **801-803**. Video server **840** comprises a communication interface for receiving video. Video server **840** may also perform other functions including storing video, processing video, analyzing video, cataloging video, distributing video, controlling video cameras **801-803**, controlling codecs **806-807**, or other functions. Video server **840** may also comprise a user interface, memory, software, other communication components, a power supply, or structural support. Video server **840** may also be a digital video recorder (DVR), video analytics engine, or other device which receives formatted video.

Video server **840** communicates with video cameras **801** and **802** at location **880** through a direct link. Video server **840** communicates with video camera **803** at location **890** through network **870**. Network **870** may be any type of communication channel which connects video server **840** to video camera **803**. Network **870** comprises a communication medium. The communication medium may be metal, air, space, optical fiber such as glass or plastic, or some other material, including combinations thereof. Network **870** may be an Internet, intranet, dedicated link, wireless link, or some other type of communication link. Network **870** could use various communication protocols, such as TDM, IP, Ethernet, telephony, optical networking, wireless protocols, or some other type of communication signaling or communication format, including combinations thereof. Network **870** may provide a direct link between the devices or may provide an indirect link which includes routers, servers, or other types of network communication devices, including combinations thereof.

Video cameras **801-803** are examples of video camera **101** although video cameras **801-803** may have alternate configurations or operate in alternate manners. Video cameras **801-803** comprise codecs **806-808**, respectively. Codecs **806-808** are examples of codec **606** although codecs **806-808** may have alternate configurations or operate in alternate manners.

Video server **840** receives video from video cameras **801-803** which has been processed and formatted by codecs **806-808**. As described with respect to FIGS. **1** and **2**, the encoder rate of codecs **806-808** are reduced if power consumption is above an acceptable range or if the temperature is above an acceptable range. Reducing the encoder rate reduces the amount of computational processing which is required thereby reducing the power consumption and heat generated. The determination process as to whether an encoder rate should be reduced may be made by video camera **801**, codec **806**, video server **840**, or another device. After an encoder rate is reduced, the codec may return the original rate when directed to by video system **800**, after a specified period of time, by command of a user, or through some other type of instruction.

In the case of location **880**, the power consumption and temperature referenced above may be associated with video cameras **806** and **807** individually, may be associated with both cameras as a combined system, or may also include other equipment of video system **800** which is at location **880**. The temperatures described above may also pertain to the general location in which the camera and codec are located.

The encoder rates of codecs **806** and **807** may be adjusted independently or may be adjusted in a synchronized fashion. Temperature data may be embedded in the video or reported separately. Responses to temperatures which are exceeding an acceptable threshold may be made in the form of adjust-

ments to encoder rates of one device in the area or adjustments to the encoder rates of multiple devices in the area. Power consumptions may relate to overall system power budgets, individual device battery levels, cabling capacity, solar panel power availability, solar panel supply forecasts, or other power source characteristics or budgeting factors.

In addition to the operation described above, video system **800** may be configured to increase encoder rates to keep a codec or camera above a minimum operating temperature. In one example, location **890** is a cold location and video camera **803** has a minimum operating temperature. The rate of codec **808** may be increased, even though it may not otherwise be needed or requested for video quality purposes, to increase the temperature of codec **808** and/or video camera **803**.

Video system **800** may also be configured to transmit notifications or alerts when encoder rates are changed as described above. These notifications or alerts may be sent to a user, a central server, or other devices in video system **800**.

In another example of operation, video system **800** may be configured to automatically change the encoder rates according to a prescribed schedule. These prescribed schedules may relate to work schedules, store hours, weather forecasts, event times, or other activities. The scheduled changes in encoder rates may also be communicated to or coordinated with the schedules and settings of heating and cooling systems. This may be necessary to minimize under or over correction of the heating and cooling systems in response to changes in encoder rates.

In another example of operation, video system **800** may be configured to reduce encoder rates of codecs **806-808** when no motion is present in the scene of its associated camera. In this manner, processing resources, power, communication bandwidth, or other resources are preserved when there is little or no information of interest in the video. When motion is detected, the encoder rate associated with that camera is increased. If this rate increase causes temperature or power thresholds to be exceeded, other encoder rates in the system may be reduced to compensate the power or heat increases. In addition, other elements of the system may be put into lower power modes or shut down altogether. These actions may also be taken if power or temperature thresholds are not exceeded but forecasts or trends indicate that they may exceeded in the near future.

FIG. **9** illustrates video system **900** which uses shared video encoder **910**. Video encoder **910** performs an operation similar to codecs **106** and codecs **306-308**, but performs these functions for multiple video cameras. Video encoder **910** may be at the same physical location as video cameras **901-902** or may be at a different physical location. The encoder rate of video encoder **910** may be adjusted for all of the reasons and in all the manners discussed in the examples above. If video encoder **910** is in a different physical location than video cameras **901-902** and video server **940**, the encoder rate may be adjusted in response to temperatures at video encoder **910** even though the temperatures at video cameras **901-902** and video server **940** are within an acceptable range.

FIG. **10** illustrates camera controller **1000**. Camera controller **1000** performs control functions for one or more video cameras like video cameras **601**, **801-803**, or **901-902**. Camera controller **1000** may be located in a video camera or may be located elsewhere in a video system. Camera controller **1000** includes communication interface **1010** and processing system **1020**. Processing system **1020** is linked to communication interface **1010** through a communication link. Processing system **1020** includes processor **1021** and memory system **1022**.

Communication interface **1010** includes network interface **1012**, input ports **1013**, and output ports **1014**. Communication interface **1010** includes components that communicate over communication links, such as network cards, ports, RF transceivers, processing circuitry and software, or some other communication device. Communication interface **1010** may be configured to communicate over metallic, wireless, or optical links. Communication interface **1010** may be configured to use TDM, IP, Ethernet, optical networking, wireless protocols, communication signaling, or some other communication format, including combinations thereof. Network **1070** is an example of network **370**. A video camera is an example of both input devices **1080** and output devices **1090**. Other examples of input devices **1080** are a user interface or a system controller. Other examples of output devices **1090** are a display or an alert system.

Processor **1021** includes microprocessor and other circuitry that retrieves and executes operating software from memory system **1022**. Memory system **1022** comprises software **1023**. Memory system **1022** may be implemented using random access memory, read only memory, a hard drive, a tape drive, flash memory, optical storage, or other memory apparatus.

Software **1023** comprises operating system **1024**, power consumption determination module **1028**, temperature determination module **1027**, and encoder rate control module **1029**. Software **1023** may also comprise additional computer programs, firmware, or some other form of non-transitory, machine-readable instructions. When executed by processor **1021**, software **1023** directs processing system **1020** to operate camera controller **1000** to achieve the results described in the examples above. Specifically, power consumption is determined using power consumption determination module **1028** and temperature is determined using temperature determination module **1027**. If either temperature or power consumption is above an acceptable range, one or more encoder rates are reduced using encoder rate control module **1029**. These changes may be communicated using output ports **1014** or network interface **1012**.

The above description and associated figures teach the best mode of the invention. The following claims specify the scope of the invention. Note that some aspects of the best mode may not fall within the scope of the invention as specified by the claims. Those skilled in the art will appreciate that the features described above can be combined in various ways to form multiple variations of the invention. As a result, the invention is not limited to the specific embodiments described above, but only by the following claims and their equivalents.

What is claimed is:

1. A method of sharing encoded video comprising:

determining a video profile for each of a plurality of devices;

determining if two or more of the video profiles are similar by determining if parameters associated with each video profile differ by less than a threshold value;

transmitting a first video stream encoded in a first format to the devices if they have similar profiles;

transmitting video streams encoded in different formats to the devices if they do not have similar profiles; and

wherein the parameters comprise at least one of a power consumption and temperature.

2. A video processing system for sharing encoded video comprising:

a processing system configured to determine a video profile for each of a plurality of devices and determine if two or more of the video profiles are similar by determining if parameters associated with each video profile differ by

less than a threshold value wherein the parameters comprise at least one of a power consumption and temperature;

a communication interface configured to transmit a first video stream encoded in a first format to the devices if they have similar profiles and transmit video streams encoded in different formats to the devices if they do not have similar profiles.

3. A non-transitory computer readable medium having instructions stored thereon for operating a video processing system, wherein the instructions, when executed by the video processing system, direct the video processing system to:

determine a video profile for each of a plurality of devices;

determine if two or more of the video profiles are similar by determining if parameters associated with each video profile differ by less than a threshold value;

transmit a first video stream encoded in a first format to the devices if they have similar profiles;

transmit video streams encoded in different formats to the devices if they do not have similar profiles; and wherein the parameters comprise at least one of a power consumption and temperature.

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